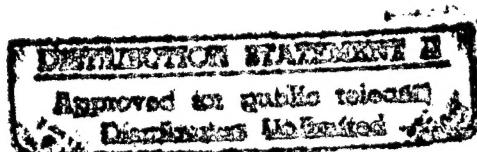


Basewide Energy Systems Plan

19971021 311

Executive Summary Final Report



Fort McClellan, Alabama

November 1982

Prepared For
MOBILE DISTRICT CORPS OF ENGINEERS
MOBILE, ALABAMA
CONTRACT DACA01-77-C-0094

Prepared By
BLACK & VEATCH
CONSULTING ENGINEERS
KANSAS CITY, MISSOURI

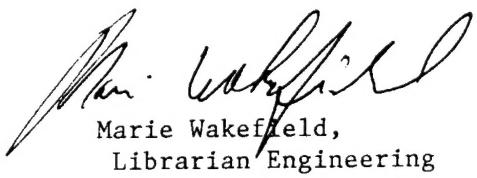


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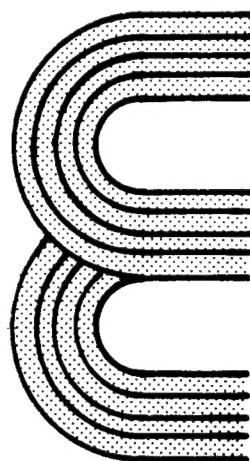
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EXECUTIVE SUMMARY - INCREMENTS A, B, C, D AND E

This is a summary of the results for Increments A, B, C, D and E of the Basewide Energy Systems Plan for Fort McClellan, Alabama. (The results of Increments F and G are summarized on pages 5 and 6). This plan includes analyses and recommendations of energy conservation projects for reduction of the installation's present energy consumption. The installation should be aware that savings figures presented in this summary can only be realized after all projects have been implemented. Black & Veatch has developed projects that would meet the funding requirements for the energy conservation program. Furthermore, the recommended projects provide partial compliance with the energy conservation requirement for the installation as outlined in the Army Facilities Energy Plan. This summary presents data on the following:

- Existing energy consumption
- Source energy reductions due to energy conservation techniques for buildings and their systems
- Application of solar energy to reduce fossil fuel consumption
- Savings utilizing central energy monitoring and control systems (EMCS)
- Use of solid waste as an alternate energy source
- Analysis of Total Energy/Selective Energy (TE/SE) systems

Tables 1 and 2 present information pertaining to the physical descriptions and energy consumption of 39 typical buildings used to verify

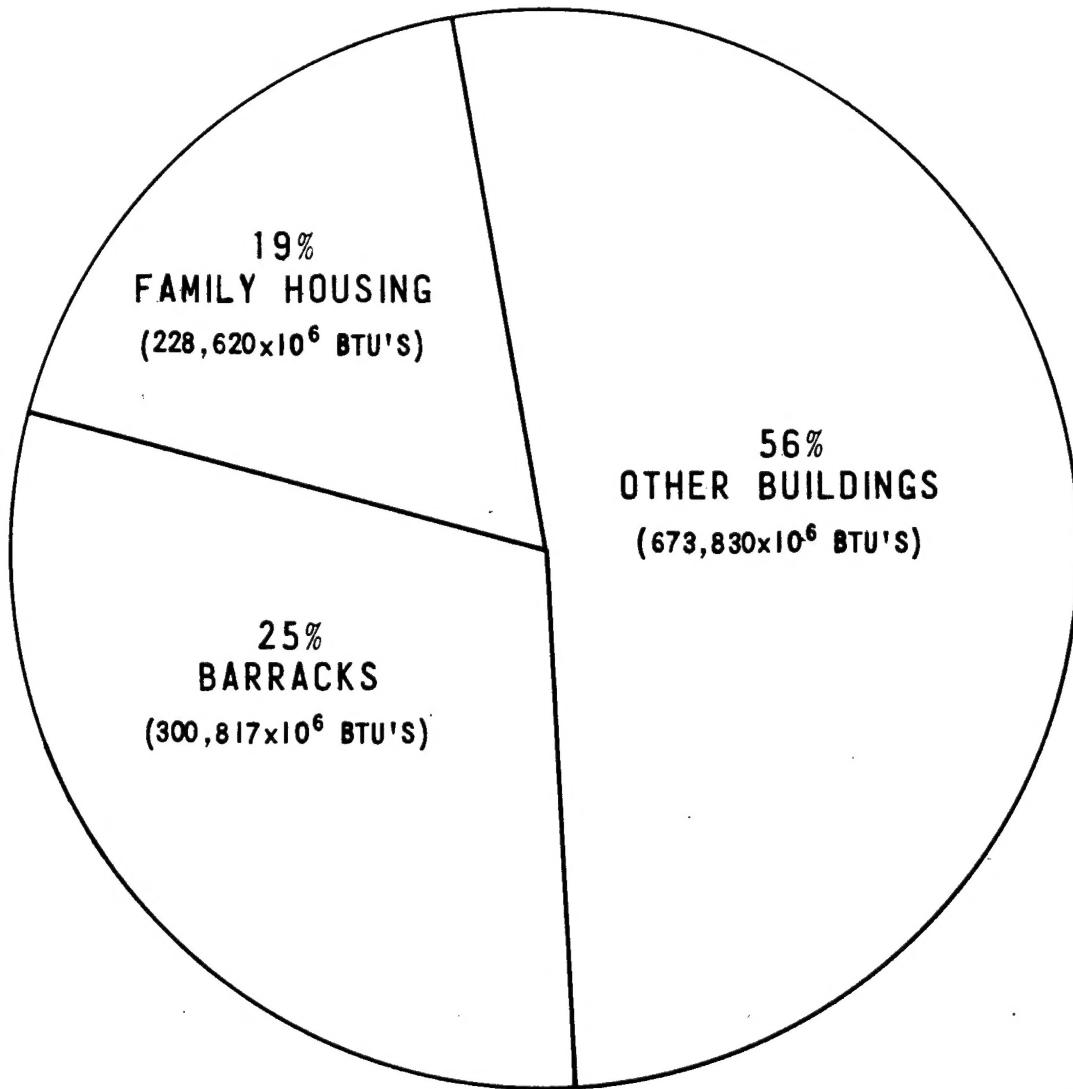
historical energy consumption in the development of the basewide energy use model. This model was then utilized as the foundation for energy conservation project analyses and recommendations. Table 3 summarizes the daily personnel occupancy for each typical building. Tables 1, 2 and 3 also provide information which may be used to estimate source energy consumption for similar buildings within the designated groupings (see Appendix A for all tables referenced in this report). The estimated annual source energy consumption for all building types contributing to the basewide annual total of 1,203,267 mega-Btu, consumed during base year 1978, is shown on Figure 1.

Table 4 indicates the annual source energy consumed by each of the significant building groups used in our basewide energy mode. Since Fort McClellan has experienced an expansion in troop housing and support facilities, our model was compared to FY 1978. This building program has been incorporated in the current building list which was then used to develop a basewide energy use model. The model was within 10 percent of the historical source energy consumption for FY 1978 shown below.

Yearly Source Energy
Consumption in Btu x 10^6

1978

Electricity	607,524
Natural Gas	479,963
Propane Gas	9,105
Fuel Oil No. 2 & 4	<u>106,640</u>
TOTAL	1,203,267



BASEWIDE CONSUMPTION FY '78

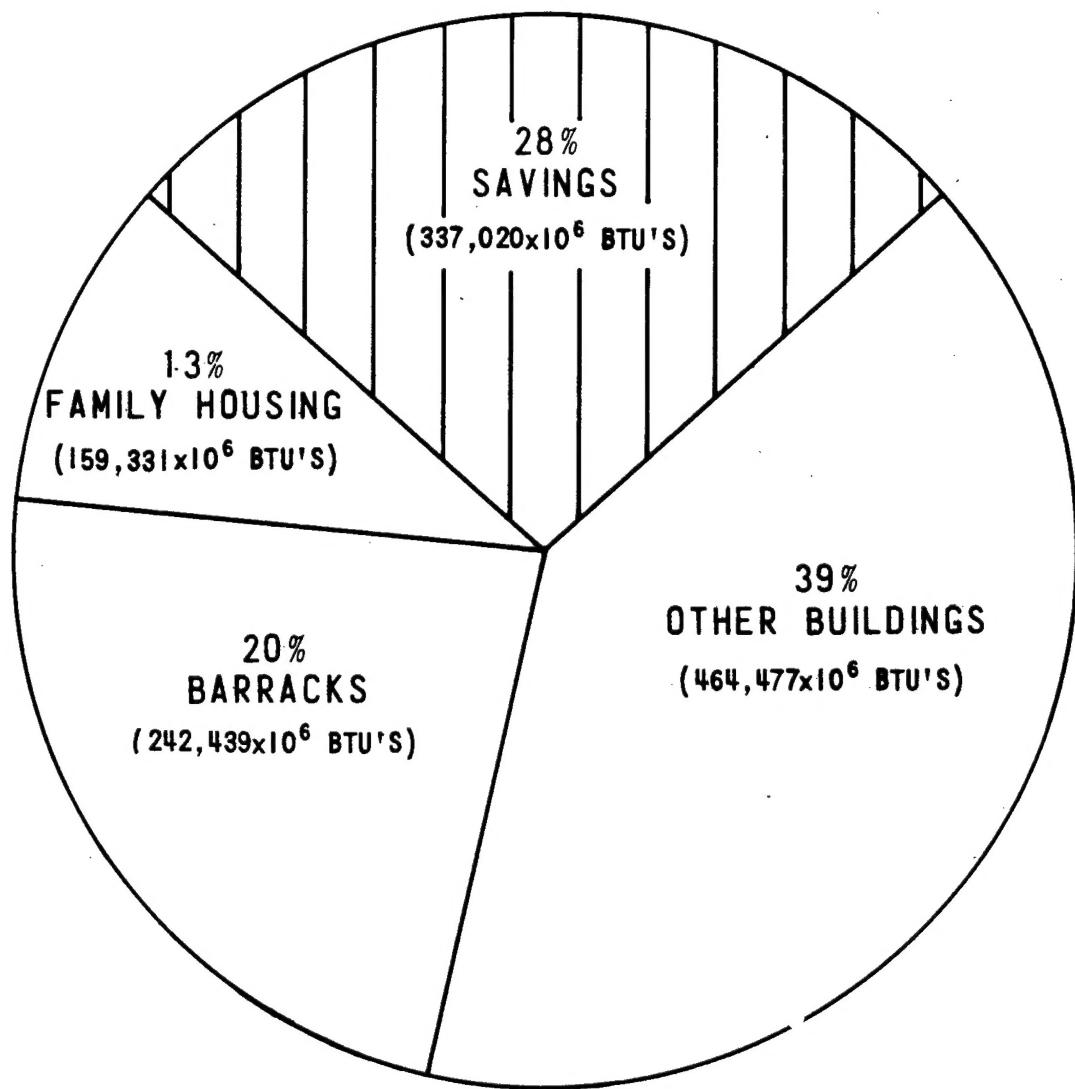
$(1,203,267 \times 10^6)$ BTU'S

FIGURE 1

The total estimated source energy savings due to implementation of all feasible energy conservation projects developed within the scope of this study is 337,020 mega-Btu/year. These projects consisted of various architectural improvements, and mechanical and electrical system modifications.

Table 5 lists the project number, percent of basewide reduction, and the source energy savings for the indicated building types. Figure 2 illustrates the combined effect of the recommended energy saving improvements, as compared to the FY 1978 source energy expenditure. Our estimates indicate a savings of approximately 28 percent over the base year (1978). Figure 3 illustrates the relative percent reduction for significant building groups comprising the 337,020 mega-Btu/year.

A detailed analysis of the projects listed in Table 5 is included in the following reports. Further explanation of the historical energy consumption, basewide energy model, and energy conservation analysis can be found in the Energy Use Survey. The reduction of Fort McClellan's dependence on nonrenewable energy sources by utilizing solar energy, a renewable energy source, indicates a total savings of 2,133 mega-Btu/year. Nine concepts were evaluated, resulting in the recommendation of Project No. T-600. The nine concepts studied are presented in the Solar Energy Applications and Evaluations. The Energy Monitoring and Control Systems (EMCS) study includes recommendations for an expansion of the existing system and the utilization of an FM control system. An expansion of the existing system would result in a 32,040 mega-Btu/year additional energy savings, while the FM control system would save 28,536 mega-Btu/year. The investigation of solid waste for reducing source energy consumption



BASEWIDE CONSUMPTION AFTER ENERGY
CONSERVATION PROJECTS
 $(866,247 \times 10^6)$ BTU'S

FIGURE 2

ALLOCATION OF ENERGY CONSERVATION
PROJECTS SAVINGS

FOR SIGNIFICANT BUILDING GROUPS

PROJECTED BASEWIDE
CONSUMPTION AFTER ENERGY
CONSERVATION PROJECTS

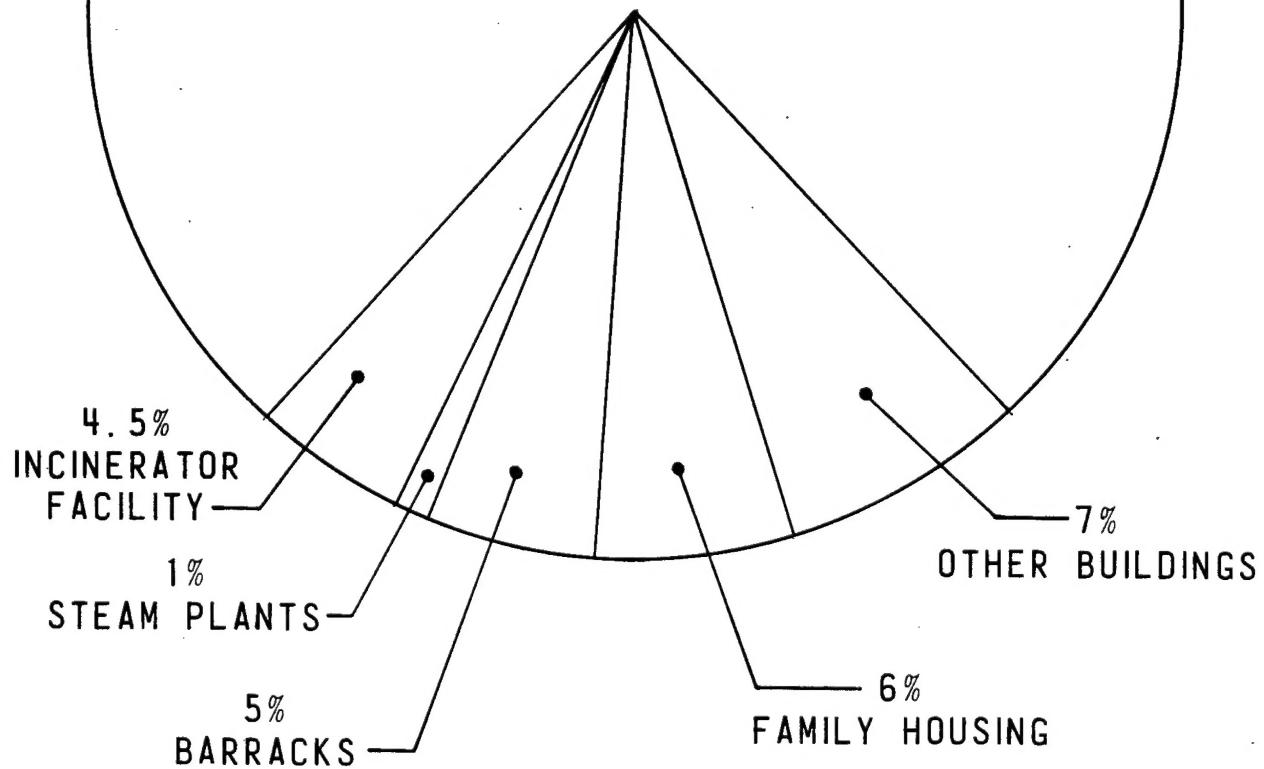


FIGURE 3

at Fort McClellan resulted in the development of Project No. T-611, which recommends the installation of a solid waste-burning incinerator facility to provide steam to the existing steam distribution system. The proposed plant, to be located near existing Boiler Plant No. 1076 would provide reduction in both fuel oil and electric consumption totalling 113,764 mega-Btu/year. The details and descriptions of the systems analyzed can be found in the report entitled Total Energy, Selective Energy, and Central Boiler Plants.

The incorporation of a total energy or selective energy system at this installation would not be recommended. The application of TE/SE systems was rejected due to the relative low steam demand that would provide a favorable electric power generation-to-heat balance and the high cost of modifying the existing steam distribution system. Detailed descriptions of the TE/SE systems analyzed are included in the Total Energy, Selective Energy, and Central Boiler Plants report.

Table 6 was developed to give a prioritized schedule, in order of fiscal year, for implementing the recommended energy conservation projects.

EXECUTIVE SUMMARY-INCREMENTS F AND G

Increment F - Facilities Engineer Conservation Measures

Increment G - Maintenance, Repair, and Minor Construction Projects

This is a summary of the two phases of work that were started after the completion of Increments A, B, C, D and E in May of 1980. Increments F and G were completed in February, 1982.

The purpose of Increments F and G of the Basewide Energy Systems Plan is to identify and develop recommendations that can be used by Fort McClellan in preparing its energy management plan. Included are a number of comparatively low cost projects, recommendations for training, prioritized lists of possible energy conservation measures, maintenance items, and minor construction projects.

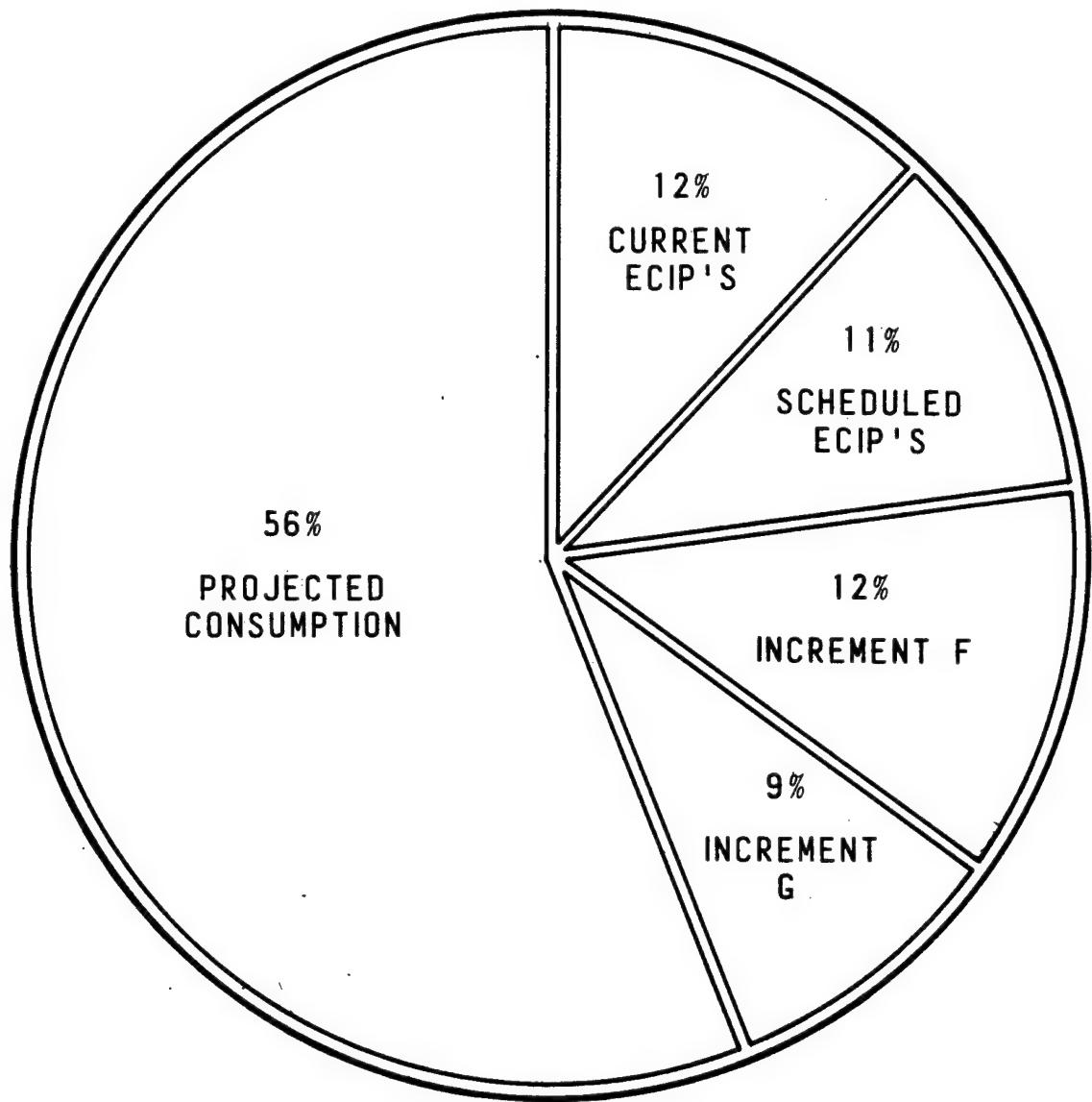
The calculations of economic paybacks for these increments of the report were done by hand, using a simple payback calculation and it should be noted that a life-cycle cost program was not used to determine economic paybacks. The cost of energy for FY 80 for natural gas ($\$2.92/10^6$ Btu) and electricity (\$.0345/kWh) were used in determining the dollar savings per year.

Recommended projects developed within the scope of Increments F and G of the study are summarized in Tables 7 and 8 respectively. Projects are prioritized by their E/C ratio. The E/C ratio is defined as the ratio of yearly energy savings in million Btu to the cost estimate in thousands of dollars. Any project showing a payback of 15 years or less was recommended. Cost estimates are representative of July, 1981 prices.

During August of 1982, Black & Veatch made a final presentation to Fort McClellan personnel of all work completed in Increments A, B, C, D, E, F and G.

Fort McClellan's projected energy consumption, if all cost effective energy conservation measures were implemented, is shown in Figure 4. Since each project developed was analyzed independently in terms of energy savings, there necessarily is an overlapping of energy savings. An effort has been made to discount that overlapping and that is represented in Figure 6.

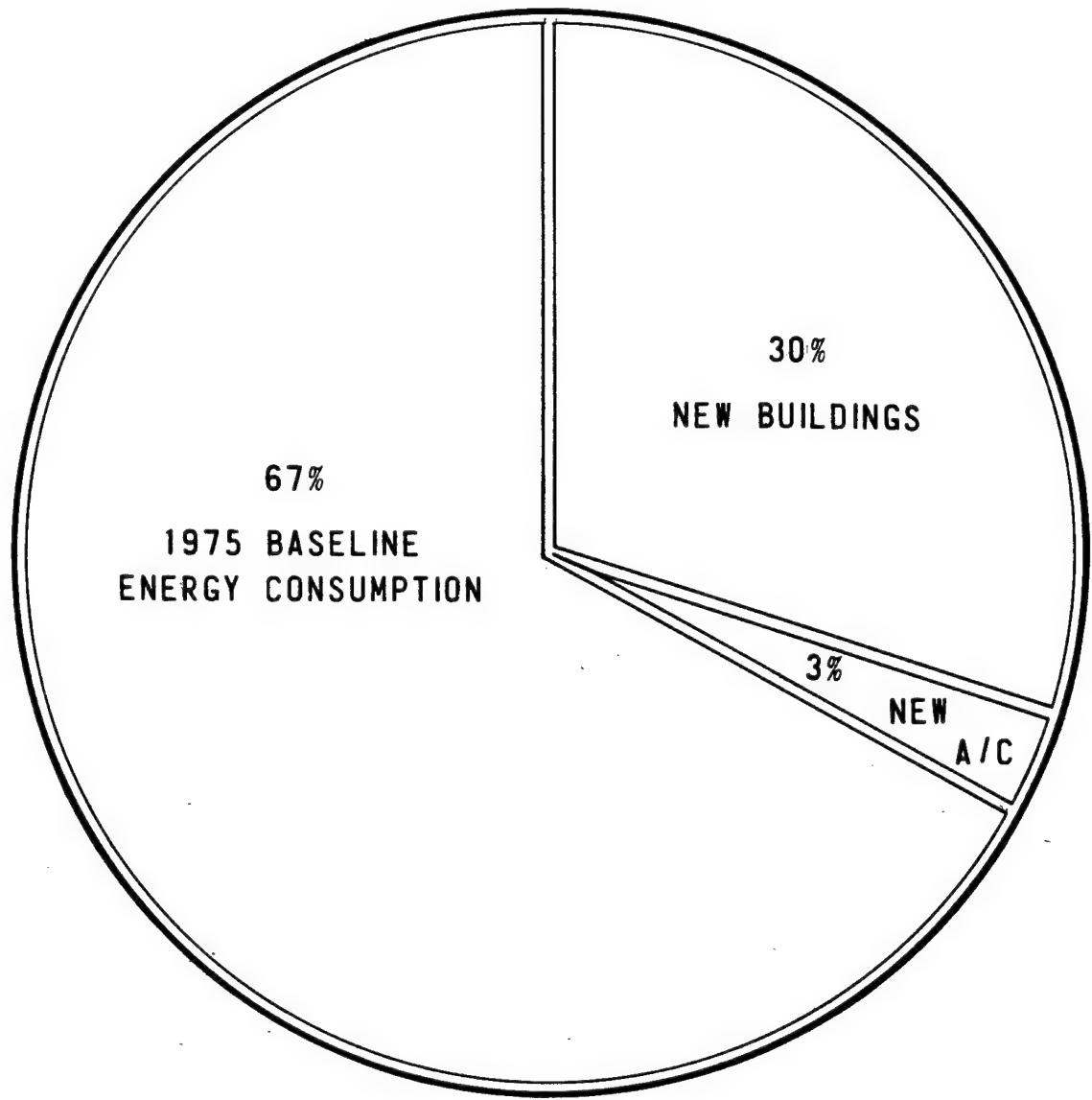
The year 1975 was selected as the base year for Fort McClellan's energy consumption. All energy consumption was to be theoretically based on this year and conservation measures were to be enacted to reduce consumption from this 1975 energy consumption. Figure 5 shows the increase in energy consumption attributed to new building and to air-conditioning added to existing buildings.



BASEWIDE CONSUMPTION FY' 81

($1,313,047 \times 10^6$ BTU'S)

FIGURE 4



BASEWIDE CONSUMPTION FY' 81

($1,313,047 \times 10^6$ BTU'S)

FIGURE 5

APPENDIX A

TABLES

TABLE I
TYPICAL BUILDING CONSTRUCTION DATA
FORT McCLELLAN

GROUP NO.	BUILDING BLDG. NO.	DESCRIPTION	NO. FLS.	CONSTRUCTION				"U" VALUES				WINDOW SQ. FT.	AREA (FT. 2)	CAP. SYSTEM (TONS)	CAP. SYSTEM	COOLING	HEATING	PEAK TRNS LOAD MBH	DOMESTIC HOT WATER CAP. FUEL (G.)		
				ROOF	WALL	FLOOR	WINDOW	DOOR	ROOF	WALL	FLOOR										
A-1	3279	ADMIN-STOREHOUSE CLASSROOM	1	ASPHALT SHINGLES	CMU	SLAB ON GRADE	SINGLE CLEAR GLASS	SOLID CORE	.31	.29	—	1.13	.89	228	2750	NONE	—	FURNACE	GAS	—	85.6
A-2	692	ADMINISTRATION	1	ASPHALT SHINGLES	TAG ON WOOD FRAME	WOOD OPEN CRAWL SPACE	SINGLE CLEAR GLASS	SOLID CORE	.06	.23	.55	1.13	.89	515	2250	NONE	—	FURNACE	GAS	16.5	26.4
A-3	65 INFORMATION	2	CLAY TILE	STUCCO ON CMU	SLAB ON GRADE	SINGLE CLEAR GLASS	STEEL HOLLOW CORE	STEEL HOLLOW CORE	.16	.40	—	1.13	.55	773	9822	MINIUM UNITS	14	BOILER	GAS	66.0	189.0
A-4	804 ADMINISTRATION	1	ASPHALT SHINGLES	ASBESTOS ON WOOD FRAME	WOOD CLOSED CRAWL SPACE	SINGLE CLEAR GLASS	METAL HOLLOW CORE	METAL HOLLOW CORE	.17	.27	.39	1.13	.85	297	2332	COND. UNIT	12	FURNACE	GAS	22.5	67.3
B-1	2224 BARRACKS	3	BUILT-UP	CMU	SLAB ON GRADE	SINGLE CLEAR GLASS	STEEL HOLLOW CORE	STEEL HOLLOW CORE	.04	.51	—	1.13	.85	392B	26416	CENTRAL PLANT	200	B.P. 2278	GAS	169.1	510.3
B-2	3238 BARRACKS	1	ASPHALT ROLL	CONCRETE BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	WOOD SOLID CORE	.26	.53	—	1.13	.89	613	6063	NONE	—	FURNACE	GAS	—	231.6
B-3	633 BARRACKS	2	COMPOSITE SHINGLES	CLAPBOARD ON WOOD FRAME	TILE, OPEN CRAWL SPACE	SINGLE CLEAR GLASS	WOOD SOLID CORE	WOOD SOLID CORE	.05	.56	.54	1.13	.89	409	4425	NONE	—	FURNACE	GAS	—	105.9
B-4	1602 BARRACKS	3	BUILT-UP	CMU	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL HOLLOW CORE	METAL HOLLOW CORE	.04	.51	—	1.13	.85	2016Z	186915	CENTRAL PLANT	62	B.P. 1876	OIL	550.6	2146.8
CS-1	2102 LIBRARY	1	BUILT-UP	BRICK AND CONCRETE BLOCK	SLAB ON GRADE TINTED	METAL HOLLOW CORE	WOOD SOLID CORE	WOOD SOLID CORE	.04	.32	—	1.13	.89	240	7060	CHILLER	2	HOT WATER BOILER	GAS	28.0	85.5
CS-2	137 HANDBALL COURT	1	ASPHALT SHINGLES	BRICK, WOOD FRAME	SLAB ON GRADE NONE	METAL HOLLOW CORE	WOOD SOLID CORE	WOOD SOLID CORE	.04	.06	—	1.13	.89	1682	1682	NONE	—	SPACE HEATERS	ELEC	—	20.6
CS-3	933 SCHOOL	1	COMPOSITE SHINGLES	CLAPBOARD ON WOOD, OPEN CRAWL SPACE	SINGLE CLEAR GLASS	WOOD SOLID CORE	WOOD SOLID CORE	WOOD SOLID CORE	.05	.32	.55	1.13	.89	3760	8201	NONE	—	FURNACE	GAS	—	107.9
CS-4	2291 POST EXCHANGE	1	BUILT-UP	CONCRETE BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	WOOD SOLID CORE	.04	.20	—	1.13	.89	40	8006	PACKAGE UNIT	15	FURNACE	GAS	25.4	92.6
CS-5	233 YOUTH CENTER	1	ASBESTOS SHINGLES	WOOD, VENTED CRANL SPACE	SINGLE PAINTED WHITE	WOOD SOLID CORE	WOOD SOLID CORE	WOOD SOLID CORE	.26	.31	.34	1.16	.89	3900	3900	NONE	—	FURNACE	GAS	—	159.2
CS-6	1928 BOWLING ALLEY	1	BUILT-UP	CMU	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	WOOD SOLID CORE	.03	.16	—	1.13	.89	20500	20500	COND. UNIT	21	BOILER	OIL	47.7	181.3
CS-7	67 CHAPEL	1	ASPHALT SHINGLES	CONCRETE	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	WOOD SOLID CORE	.51	.55	—	1.13	.89	512	5629	PACKAGE UNIT	20	FURNACE	GAS	61.8	291.9
D-1	1001 DINING HALL	1	BUILT-UP	CONCRETE BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	STEEL HOLLOW CORE	STEEL HOLLOW CORE	.18	.53	—	1.13	.85	3956	11634	COND. UNIT	4	B.P. 1076	STEAM	79.2	342.7
D-2	3206 DINING HALL	1	ASPHALT SHINGLES	CONCRETE BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD HOLLOW CORE	WOOD HOLLOW CORE	.25	.53	—	1.13	.89	182	3729	NONE	—	UNLT HEATER	GAS	—	125.8
FH-1	13 FIELD OFFICER QUARTERS	2	CLAY TILE	STUCCO	WOOD	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.07	.42	.39	1.13	.89	5173	4232	MINIUM UNITS	4	FURNACE	GAS	16.5	91.5
FH-2	3510 FAMILY HOUSING	1	BUILT-UP	BRICK, WOOD FRAME	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	WOOD SOLID CORE	.05	.10	—	1.13	.89	2846	2846	COND. UNIT	3	FURNACE	GAS	5.8	21.8
FH-3	3659 DUPLEX	1	PITCH & GRAVEL	FACE BRICK, WOOD FRAME	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD, STORM DOOR	WOOD, STORM DOOR	.07	.27	—	1.13	.89	409	9236	MINIUM UNITS	6	FURNACE	GAS	26.3	85.0
FH-4	3531 FAMILY HOUSING	1	BUILT-UP	FACE BRICK	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	WOOD SOLID CORE	.31	.25	—	1.13	.89	450	5480	COND. UNIT	11	FURNACE	GAS	45.0	136.5
FH-5	3716 FAMILY HOUSING	2	BUILT-UP	WOOD SIDING AND FRAME	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	WOOD SOLID CORE	.31	.22	—	1.13	.89	566	5264	COND. UNIT	11	FURNACE	GAS	45.0	127.0
FH-6	3732 FAMILY HOUSING	2	BUILT-UP	FACE BRICK WOOD SIDING	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	WOOD SOLID CORE	.05	.22	—	1.13	.89	2034	10704	PACKAGE	58	FURNACE	GAS	62.6	197.1
MA-1	3139 MAINTENANCE & REPAIR	6	CONCRETE & CMU	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.11	.67	1.13	.89	—	1.13	.85	960	5028	NONE	—	UNLT HEATERS	GAS	—	145.0
MA-2	1696 MAINTENANCE SHOP	1	COMPOSITE SHINGLES	ASBESTOS ON WOOD FRAME	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	WOOD SOLID CORE	.26	.27	—	1.13	.89	231	5108	MINIUM UNITS	1	UNLT HEATER	GAS	9.1	72.7
ME-1	2290 MEDICAL DISPENSARY	2	BUILT-UP	CMU	BASEMENT	SINGLE CLEAR GLASS	METAL HOLLOW CORE	WOOD HOLLOW CORE	.07	.32	—	1.13	.89	1997	8876	CENTRAL PLANT	48	B.P. 2278	GAS	90.9	259.1

TABLE I (CONT'D)
TYPICAL BUILDING CONSTRUCTION DATA
FORT McCLELLAN

TABLE 2
TYPICAL BUILDING ENERGY CONSUMPTION DATA
FORT McCLELLAN

GROUP NO.	BLDG.	BUILDING DESCRIPTION	ANNUAL ENERGY SOURCE CONSUMPTION BTUx10 ³			ELEC'L ENER. CONSUMPTION		BTU x 10 ³ FT ²
			FUEL	ELEC.	TOTAL	KW PEAK	KWH/YR	
A-1	3279	ADMIN-STOREROUSE CLASSROOM	364	84	468	2	7183	170.2
A-2	692	ADMINISTRATION	631	191	822	7	16446	365.3
A-3	65	MANAGEMENT INFORMATION	1013	3114	4127	67	268430	420.2
A-4	804	ADMINISTRATION	353	241	594	11	20715	266.1
B-1	2224	BARRACKS	8663	3166	11829	64	272890	324.8
B-2	3238	BARRACKS	829	326	1155	12	28070	190.5
B-3	833	BARRACKS	593	138	731	4	11897	165.2
B-4	1802	BARRACKS	47251	14714	61965	324	1268444	331.5
CS-1	2102	LIBRARY	493	1552	2045	57	133765	289.7
CS-2	137	HANDBALL COURT	0	287	287	13	24725	170.6
CS-3	933	SCHOOL	726	235	961	9	20272	228.8
CS-4	2291	POST EXCHANGE	410	2056	2466	66	177206	307.9
CS-5	233	YOUTH CENTER	623	267	890	8	23037	261.8
CS-6	1928	BOWLING ALLEY	247	3196	3443	70	275496	279.1
CS-7	67	CHAPEL	1194	696	1890	47	60036	324.2
D-1	1001	DINING HALL	13970	3712	17682	107	320021	1494.2
D-2	3206	DINING HALL	3169	374	3543	7	32231	950.1
FH-1	13	FIELD OFFICER QUARTERS	436	569	1005	18	58383	237.5
FH-2	3510	FAMILY HOUSING	148	262	410	6	22625	167.6
FH-3	3669	DUPLEX	899	463	1362	20	39892	420.6
FH-4	3531	FAMILY HOUSING	753	558	1311	23	48132	239.2
FH-5	3716	FAMILY HOUSING	736	636	1372	22	54821	260.6
FH-6	3732	FAMILY HOUSING	1136	1956	3092	92	168609	288.9
MA-1	3139	MAINTENANCE & REPAIR	109	74	183	2	6398	36.4
MA-2	1696	MAINTENANCE SHOP	255	171	426	5	14716	137.1
ME-1	2290	MEDICAL DISPENSARY	2494	502	2996	16	43264	337.5

TABLE 2 (CONT'D)
TYPICAL BUILDING ENERGY CONSUMPTION DATA
FORT McCLELLAN

TABLE 3
BUILDING OCCUPANCY
FORT McCLELLAN

GROUP NO.	BLDG.	BUILDING DESCRIPTION	NORMAL PEAK POPULATION	OCCUPANCY
A-1	3279	ADMIN-STOREROOM CLASSROOM	13	OPEN 24 HOURS
A-2	692	ADMINISTRATION	4	WEEKDAYS - 7:30 A.M. TO 4:15 P.M.
A-3	65	MANAGEMENT INFORMATION	21	WEEKDAYS - 7:30 A.M. TO 4:15 P.M.
A-4	804	ADMINISTRATION	13	WEEKDAYS - 7:00 A.M. TO 4:00 P.M.
B-1	2224	BARRACKS	161	OPEN 24 HOURS
B-2	3238	BARRACKS	65	OPEN 24 HOURS
B-3	853	BARRACKS	33	OPEN 24 HOURS
B-4	1802	BARRACKS	880	OPEN 24 HOURS
CS-1	2102	LIBRARY	30	MONDAY THRU THURSDAY - 11:00 A.M. TO 8:00 P.M., FRIDAY THRU SATURDAY - 9:00 A.M. TO 5:00 P.M., SUNDAY 1:00 P.M. TO 5:00 P.M.
CS-2	137	HANDBALL COURT	9	7 DAYS A WEEK - 8:00 A.M. TO 5:00 P.M.
CS-3	933	SCHOOL	32	WEEKDAYS - 8:00 A.M. TO 2:00 P.M.
CS-4	2291	POST EXCHANGE	57	7 DAYS A WEEK - 8:00 A.M. TO 9:00 P.M.
CS-5	233	YOUTH CENTER	10	WEEKDAYS - 7:30 A.M. TO 7:00 P.M. SATURDAY 3:00 A.M. TO 11:00 P.M.
CS-6	1928	BOWLING ALLEY	165	MONDAY THRU SATURDAY - 9:00 A.M. TO 11:00 P.M., SUNDAY AND HOLIDAYS - 12:00 NOON TO 9:00 P.M.
CS-7	67	CHAPEL	157	SUNDAY THRU FRIDAY - 7:15 A.M. TO 4:15 P.M.
D-1	1001	DINING HALL	30	MONDAY THRU SATURDAY - 4:00 A.M. TO 7:00 P.M. SUNDAY - 6:30 A.M. TO 7:00 P.M.
D-2	3206	DINING HALL	190	WEEKDAYS - 5:30 A.M. TO 6:00 P.M.
FH-1	13	FIELD OFFICER QUARTERS	5	OPEN 24 HOURS
FH-2	3510	FAMILY HOUSING	5	OPEN 24 HOURS
FH-3	3669	DUPLEX	9	OPEN 24 HOURS
FH-4	3531	FAMILY HOUSING	16	OPEN 24 HOURS
FH-5	3716	FAMILY HOUSING	14	OPEN 24 HOURS
FH-6	3732	FAMILY HOUSING	32	OPEN 24 HOURS
MA-1	3139	MAINTENANCE AND REPAIR	16	WEEKDAYS - 7:00 A.M. TO 4:00 P.M.
MA-2	1696	MAINTENANCE SHOP	11	WEEKDAYS - 7:30 A.M. TO 4:00 P.M.
MED-1	2290	MEDICAL DISPENSARY	15	WEEKDAYS - 7:00 A.M. TO 4:00 P.M.
T-1	3185	TRAINING	32	WEEKDAYS - 7:00 A.M. TO 5:00 P.M.
T-2	276	CLASSROOM	15	WEEKDAYS - 7:30 A.M. TO 4:15 P.M.
U-1	5728	SEWAGE TREATMENT	5	OPEN 24 HOURS
U-2	56	FILTER HOUSE	-	OPEN 24 HOURS
U-3	5700	SEWAGE PUMPING STATION	-	OPEN 24 HOURS
U-4	3176	BOILER PLANT	1	OPEN 24 HOURS
W-1	202	WAREHOUSE	5	WEEKDAYS - 7:30 A.M. TO 4:15 P.M.
W-2	221	WAREHOUSE	12	WEEKDAYS - 7:30 A.M. TO 4:15 P.M.
NG-1	1312	BARRACKS	170	OPEN 24 HOURS
NG-2	1396	BARRACKS	80	OPEN 24 HOURS
NG-3	1315	BARRACKS	180	OPEN 24 HOURS

TABLE 4
Building Group Source Energy Consumption

Group	Description	Group Sq. Ft.	Total Source Consumption Btu's x 10 ⁶
A	Administrative	482,594	154,544
B	Barracks	1,910,278	332,113
CS	Community Service	615,027	153,773
D	Dining	117,162	124,188
FH	Family Housing	843,221	245,007
MA	Maintenance	155,161	13,636
ME	Medical	132,780	44,820
T	Training	449,100	73,223
U-1	Waste Water Treatment	695	6,637
U-2	Water Treatment	1,648	876
U-3	Pump Houses	1,313	16,372
U-4	Boiler Plants	23,437	2,299
W	Warehouses	506,952	75,891
NG	National Guard	114,533	5,121
X	No Utilities	60,847	--
Z	Electricity Only (Includes outdoor lights)	58,081	52,040

ENERGY CONSERVATION PROJECTS
SOURCE ENERGY SAVINGS

BUILDING TYPE	ENERGY SAVINGS BTUx1,000,000	% BASEWIDE REDUCTION FY'78	PROJECT NUMBER
FAMILY HOUSING	18,685 50,604 <hr/> 69,289	1.55 4.21 <hr/> 5.76	T-608 T-605
BARRACKS	33,093 8,048 8,380 4,854 4,003 <hr/> 58,378	2.75 0.67 0.70 0.40 0.33 <hr/> 4.85	T-603 T-613 T-602 T-601 T-610
INCINERATOR FACILITY	113,764	9.45	T-611
STEAM PLANTS	8,142	0.68	T-612
OTHER BUILDINGS AFFECTED BY ECIP'S	2,133 13,161 15,338 9,851 22,972 23,992 <hr/> 87,447	0.18 1.09 1.27 0.82 1.91 1.99 <hr/> 7.26	T-600 T-602 T-601 T-608 T-610 T-613
TOTAL	337,020	28.00	

TABLE 5

ENERGY CONSERVATION PROJECTS DEVELOPED SCHEDULE - FT. McCLELLAN, ALABAMA

PROJECT TITLE	PROJECT NUMBER	RECOMMENDED FISCAL YEAR	COST \$ x 1000	E/C RATIO	ENERGY SAVINGS BTU/x1,000,000	YEARS PAYBACK	B/C RATIO
SOLAR HEATING OF FIELDHOUSE SWIMMING POOL AND SHOWER WATER	T-600	1981	137	15.8	2,133	14.0	1.36
INSULATION, INSULATED PANELS, STORM WINDOWS, AND WEATHERSTRIPPING IN PERMANENT BARRACKS	T-603	1981	944	35.1	33,093	8.5	2.20
INSULATION, WEATHERSTRIPPING, AND STORM WINDOWS IN TEMPORARY BUILDINGS	T-602	1981	653	32.97	21,541	10.8	1.74
RELAMPING FLUORESCENT FIXTURES	T-601	1981	231	87.4	20,192	2.4	3.45
FM RADIO CONTROL	T-608	1981	404	70.63	28,536	4.0	3.12
TOTAL			2369		105,495		
MODIFY FRESH AIR QUANTITIES	T-610	1982	51	528.0	26,975	0.5	34.70
SOLID WASTE BURNING INCINERATOR FACILITY	T-611	1982	4063	28.0	113,764	12.3	2.04
FAMILY HOUSING IMPROVEMENTS	T-605	1982	1027	51.9	50,604	6.5	2.80
BOILER PLANT 1876 - SUMMER SHUTDOWN	T-612	1982	122	86.7	8,142	2.5	7.67
EMCS EXPANSION	T-613	1982	209	153.2	32,040	2.1	5.60
TOTAL			5472		231,525		

TABLE 6

TABLE 7

Summary of Increment F Projects

<u>Project</u>	<u>Location(s)</u>	<u>Energy Savings/Year MMBtu</u>	<u>Dollar Savings/Year</u>	<u>Payback Years</u>	<u>E/C</u>	<u>Contract Cost</u>	<u>In-House Cost Material</u>	<u>In-House Cost Manhours</u>	<u>Reference Pages Narr. Calcs.</u>
Reduction of Ventilation Air Quantities	Bldg. 292	20,546	\$ 60,410	.003	114,144	\$ 180	\$ 0	A/C Mechanic 9	12 A48-A49
Reduction of Ventilation Air Quantities	Bldg. 1929	3,086	9,073	.01	77,150	40	0	A/C Mechanic 2	12 A31
Reduction of Ventilation Air Quantities	Bldg. 1965	1,355	3,985	.01	33,875	40	0	A/C Mechanic 2	12 A32
Reduction of Ventilation Air Quantities	Bldg. 246	540	1,587	.03	13,500	40	0	A/C Mechanic 2	12 A22
Reduction of Ventilation Air Quantities	Bldg. 141	966	2,840	.03	12,075	80	0	A/C Mechanic 4	12 A18
Reduction of Ventilation Air Quantities	Bldg. 1928	728	9,224	.04	11,600	80	0	A/C Mechanic 4	12 A30
Reduction of Ventilation Air Quantities	Bldg. 1081	7,352	21,617	.03	10,800	680	0	A/C Mechanic 34	12 A27
Reduction of Ventilation Air Quantities	Bldg. 1881	3,737	10,988	.03	10,380	360	0	A/C Mechanic 18	12 A29
Reduction of Ventilation Air Quantities	Bldg. 2101	379	1,114	.04	9,475	40	0	A/C Mechanic 2	12 A34
Reduction of Ventilation Air Quantities	Bldg. 3181	3,106	9,133	.04	8,628	360	0	A/C Mechanic 18	12 A45
Reduction of Ventilation Air Quantities	Bldg. 2041	646	1,899	.04	8,075	80	0	A/C Mechanic 4	12 A30
Reduction of Ventilation Air Quantities	Bldg. 128	276	812	.05	6,900	40	0	A/C Mechanic 2	12 A17
Reduction of Ventilation Air Quantities	500 Area	3,517	13,281	.05	6,280	560	0	A/C Mechanic 28	12 A24
Reduction of Ventilation Air Quantities	Bldg. 3170	439	1,291	.06	5,488	80	0	A/C Mechanic 4	12 A44
Reduction of Ventilation Air Quantities	Bldg. 2293	419	1,232	.06	5,238	80	0	A/C Mechanic 4	12 A40

TABLE 7

Summary of Increment F Projects
(Cont'd)

<u>Project</u>	<u>Location(s)</u>	<u>Energy Savings/Year MMBtu</u>	<u>Dollar Savings/Year</u>	<u>Payback Years</u>	<u>E/C</u>	<u>Contract Cost</u>	<u>Material</u>	<u>In-House Cost Manhours</u>	<u>Reference Pages</u>
Reduction of Ventilation Air Quantities	Bldg. 2220	833	2,449	.07	5,206	160	0	A/C Mechanic	8
Reduction of Ventilation Air Quantities	Bldg. 2221	833	2,449	.07	5,206	160	0	A/C Mechanic	8
Reduction of Ventilation Air Quantities	Bldg. 2223	833	2,449	.07	5,206	160	0	A/C Mechanic	8
Reduction of Ventilation Air Quantities	Bldg. 2224	833	2,449	.07	5,206	160	0	A/C Mechanic	8
Reduction of Ventilation Air Quantities	Bldg. 2225	833	2,449	.07	5,206	160	0	A/C Mechanic	8
Reduction of Ventilation Air Quantities	Bldg. 2227	833	2,449	.07	5,206	160	0	A/C Mechanic	8
Reduction of Ventilation Air Quantities	Bldg. 1021	740	2,161	.07	4,625	160	0	A/C Mechanic	8
Reduction of Ventilation Air Quantities	Bldg. 161	169	496	.08	4,217	120	0	A/C Mechanic	6
Reduction of Ventilation Air Quantities	Bldg. 162	169	496	.08	4,217	120	0	A/C Mechanic	6
Reduction of Ventilation Air Quantities	Bldg. 163	169	496	.08	4,217	120	0	A/C Mechanic	6
Reduction of Ventilation Air Quantities	Bldgs. 1601, 1602 1801, 1802	3,372	11,868	.08	4,215	800	0	A/C Mechanic	40
Reduction of Ventilation Air Quantities	Bldg. 2291	3,329	9,200	.09	4,011	830	750	A/C Mechanic	4
Reduction of Ventilation Air Quantities	Bldg. 1020	768	2,390	.08	3,840	200	0	A/C Mechanic	10
									12 A39
									12 A25

Reference Pages

Narr. Calcs.

TABLE 7

Summary of Increment F Projects
 (Cont'd)

<u>Project</u>	<u>Location(s)</u>	<u>Energy Savings/Year MMBtu</u>	<u>Dollar Savings/Year</u>	<u>Payback Years</u>	<u>E/C</u>	<u>Contract Cost</u>	<u>In-House Cost Manhours</u>	<u>Reference Pages</u>
								Narr. Calcs.
Reduction of Ventilation Air Quantities	Bldg. 1022	768	2,390	.08	3,840	200	0	A/C Mechanic 10 12 A25
Reduction of Ventilation Air Quantities	Bldg. 1023	768	2,390	.08	3,840	200	0	A/C Mechanic 10 12 A25
Reduction of Ventilation Air Quantities	Bldg. 3212	768	2,390	.08	3,840	200	0	A/C Mechanic 10 12 A25
Reduction of Ventilation Air Quantities	Bldg. 57	1,470	4,322	.09	3,675	400	0	A/C Mechanic 20 12 A14
Reduction of Ventilation Air Quantities	Bldg. 3191	2,108	6,198	.10	3,513	600	0	A/C Mechanic 30 12 A46
Reduction of Ventilation Air Quantities	Bldg. 3165	1,121	3,002	.06	3,397	330	250	A/C Mechanic 4 12 A42
Reduction of Ventilation Air Quantities	Bldg. 3184	1,121	3,002	.06	3,397	330	250	A/C Mechanic 4 12 A42
Reduction of Ventilation Air Quantities	Bldg. 67	264	776	.23	3,300	80	0	A/C Mechanic 4 12 A16
Deactivate Outside Air Fans	Bldg. 3136	1,133	3,370	.10	3,062	370	50	Electrician 16 25 A67-A68
Reduction of Ventilation Air Quantities	Bldg. 2275	6,399	18,815	.11	3,018	2,120	0	A/C Mechanic 106 12 A38
Reduction of Ventilation Air Quantities	Bldg. 2276	6,399	18,815	.11	3,018	2,120	0	A/C Mechanic 106 12 A38
Reduction of Ventilation Air Quantities	Bldg. 63	1,182	3,476	.12	2,955	400	0	A/C Mechanic 20 12 A15
Reduction of Ventilation Air Quantities	Bldg. 229	552	1,623	.13	2,629	210	150	A/C Mechanic 3 12 A21
Reduction of Ventilation Air Quantities	Bldg. 2102	306	812	.13	2,550	120	0	A/C Mechanic 6 12 A35

TABLE 7

Summary of Increment F Projects
(Cont'd)

<u>Project</u>	<u>Location(s)</u>	<u>Energy Savings/Year MMBtu</u>	<u>Dollar Savings/Year</u>	<u>Payback Years</u>	<u>E/C</u>	<u>Contract Cost</u>	<u>In-House Cost Material</u>	<u>In-House Cost Manhours</u>	<u>Reference Pages</u>
									<u>Narr. Calcs.</u>
Reduction of Ventilation Air Quantities	Bldg. 1060	3,137	9,224	.13	2,530	1,240	1,000	A/C Mechanic	12 12 A26
Reduction of Ventilation Air Quantities	Bldg. 2213	1,169	3,437	.15	2,338	500	0	A/C Mechanic	25 12 A36
Reduction of Ventilation Air Quantities	Bldg. 3169	655	1,953	.15	1,945	330	250	A/C Mechanic	4 12 A43
Reduction of Ventilation Air Quantities	Bldg. 3131	1,794	5,150	.19	1,794	1,000	0	A/C Mechanic	50 12 A41
Reduction of Ventilation Air Quantities	Bldg. 3135	1,794	5,150	.19	1,794	1,000	0	A/C Mechanic	50 12 A41
Flow Control Shower Heads	82 Bachelors Quarters	42,000	122,640	.25	1,342	31,300	22,300	Plumber	450 16 A4-A8
Reduction of Ventilation Air Quantities	Bldg. 215	289	849	.28	1,204	240	0	A/C Mechanic	12 12 A20
Reduction of Ventilation Air Quantities	Bldg. 267	1,204	3,540	.32	1,075	1,120	800	A/C Mechanic	16 12 A23
Receptacle Insulation	All Heated Buildings	29,552	17,354	1.9	910	32,930	7,250	General	1,284 35 A56-A58
Street Light Reduction	Basewide	6,554	19,495	.44	766	8,553	2,113	Electrician	322 30 A90-A92
Swimming Pool Cover	Bldg. 1012	482	1,407	.65	526	917	917 0		39 A85-A89
Lower Thermostat Settings and Night Setback	Family Housing	22,500	65,679	1.04	328.9	68,400	57,000	Electrician	570 27 A63-A66

TABLE 7

Summary of Increment F Projects
(Cont'd)

<u>Project</u>	<u>Location(s)</u>	<u>Energy Savings/Year MMBtu</u>	<u>Dollar Savings/Year</u>	<u>Payback Years</u>	<u>E/C</u>	<u>Contract Cost</u>	<u>In-House Cost Manhours</u>	<u>Reference Pages</u>
Duct Insulation in Unconditioned Spaces	Bldg. 1081	34	101	1.66	205	168	48	Insulator 6 10 A1
Duct Insulation in Unconditioned Spaces	Bldg. 3212	279	818	1.69	202	1,379	389	Insulator 49 10 A2
Duct Insulation in Unconditioned Spaces	Bldg. 2293	62	202	1.66	184	336	96	Insulator 12 10 A3
Reduce Infiltration in Family Housing	Family Housing	8,240	24,231	3.8	88.9	125,400	17,100	General 4,560 28 A59-A62
Variable Air Volume	Bldg. 292	6,124	18,212	3.66	91.8	66,675	46,675	A/C Mechanic 40 A82-A84
Heat Recovery from Dust Collector	Bldg. 215	86	251	4.1	83.3	1,030	865	Sheet Metal Worker 8 20 A48-A53
Cleaning of Air Handling Units (Unit Prices)	1600 Area	31	93	4.3	78	400	60	A/C Mechanic 17 33 A102-A111
Water Heater Tank Insulation	Most Buildings	988	2,891	6.5	52.6	18,800	9,400	Insulator 470 24 A10-A11
Change Over Electric Water Heaters to Natural Gas	35 Bldgs.	1,075	3,371	6.1	52.3	20,545	17,045	Pipefitter 140 Electrician 35 37 A69-A70
Window Insulation	Bldg. 256	135	397	6.8	50.1	2,700	1,350	General 68 22 A73
Window Insulation	Bldg. 1012	174	511	6.8	50.1	3,480	1,740	General 87 22 A74
Window Insulation	Bldg. 2203	8	22	6.8	50.1	150	75	General 4 22 A75

TABLE 7
Summary of Increment F Projects
(Cont'd.)

Project	Location(s)	Energy Savings/Year MMBtu	Dollar Savings/Year	Payback Years	E/C Cost	Contract Cost	In-House Cost Material	In-House Cost Manhours	Reference Pages Narr. Calcs.
Window Insulation	Bldg. 2213	169	496	6.8	50.1	3,375	1,688	General 85	22 A76
Window Insulation	Bldg. 3165	13	37	6.8	50.1	256	128	General 8	22 A78
Window Insulation	Bldg. 3170	49	142	6.8	50.1	972	486	General 24	22 A79
Window Insulation	Bldg. 229	26	76	8.0	43.1	600	30	General 15	22 A71
Window Insulation	Bldg. 234	91	264	8.0	43.1	2,100	1,050	General 53	22 A72
Window Insulation	Bldg. 3138	39	113	8.0	43.1	900	450	General 23	22 A77
Low Pressure Sodium Street Lighting	Basewide	826	2,455	20.5	16.4	338,200	250,700	Electrician 5068	44 A116-A126
Fluorescent Lighting Ballast Replacement	Basewide	.531	1.58	17.1	14.8	27.0			43 A112-A115
Air Curtains for Warehouse Loading Doors	Bldg. 3170	11	26	53.8	7.9	1,400	1,300	Electrician 3 General 2	19 A9
Power Factor Improvement	Distribution System	0	32,393	.78	0	25,240	18,000	Electrician 365	17 A93-A101

TABLE 8
SUMMARY OF PROJECT DATA

Project	Location(s)	Energy Savings/Year MMBTU	Dollar Savings/Year Savings/Yr	Payback Years E/C	Contract Cost Manhours	In-House Cost Material Manhours	Reference Pages	
							Narr.	Calcs.
Programmable Thermostats	78 Bldg.	24,130	70,460	.45	761.7	31,680	26,400	Electrician 264
Steam Heat Controls Modification	13 Barracks	15,790	46,108	1.98	173.1	91,000	43,000	Pipefitter 2,400
Chiller Modulation	Bldg. 1776	6,161	18,323	2.20	154.0	40,000	-	-
Variable Speed Chilled Water Pumping	Bldg. 1876	11,488	34,168	2.80	122.0	94,340	93,700	Electrician 16 Plumber 16
Fluorescent Lighting Load Reduction	Basewide	26,124	77,697	2.80	120.5	217,000	151,000	Electrician 3800
Automatic Chiller Condenser Tube Cleaning	Bldg. 1776	5,342	15,888	2.90	116.0	46,100	40,120	Pipefitter 300
Variable Speed Hot Water Pumping	Bldg. 1876	1,606	4,777	3.1	108.0	14,820	14,500	Electrician 8 Plumber 8
Boiler Upgrade	Bldg. 63	1,037	3,028	3.17	108.0	9,613	8,173	Pipefitter 30 Sheet Metal Worker 30 Electrician 12
Boiler Upgrade	Bldg. 65	926	1,545	3.17	108.0	4,895	3,935	Pipefitter 20 Sheet Metal Worker 20 Electrician 8
Boiler Upgrade	Bldg. 51	981	2,865	3.19	107.0	9,129	7,689	Pipefitter 30 Sheet Metal Worker 30 Electrician 12

TABLE 8
SUMMARY OF PROJECT DATA
(Continued)

<u>Project</u>	<u>Location(s)</u>	<u>Energy Savings/Year</u>	<u>Dollar Savings/Year</u>	<u>Payback Years</u>	<u>E/C</u>	<u>Contract Cost</u>	<u>Material</u>	<u>In-House Cost Manhours</u>	<u>Reference Narr.</u>	<u>Pages Calcs.</u>
Corridor Lighting Timed Night Setback	Bldg. 292	1,148	3,413	3.50	96.7	12,000	5,750	Electrician 115	33	B76-B81
Ceiling Fans	Bldgs. 234 & 236	853	2,410	3.79	93.4	9,100	2,800	Electrician 187 General 21	23	B48-B51
Ceiling Fans	Bldg. 1012	496	4,686	1.19	88.6	5,600	1,750	Electrician 114 General 13	23	B56-B59
Steam Heat Controls Modification	45 Bldgs.	19,997	58,391	3.90	87.6	228,000	152,000	Pipefitter 3,800	36	B82-B85
Ceiling Fans	Bldgs. 335 & 338	542	1,530	4.62	76.7	7,060	2,200	Electrician 145 General 16	23	B52-B56
Ceiling Fans	Bldg. 130	526	1,480	4.71	75.4	7,000	2,200	Electrician 140 General 18	23	B39-B43
Automatic Chiller Condenser Tube Cleaning	Bldg. 2278	1,149	3,418	4.54	73.9	15,500	12,600	Pipefitter 140	9	B98-B107A
Automatic Chiller Condenser Tube Cleaning	Bldg. 503	1,021	3,037	4.71	71.4	14,300	11,700	Pipefitter 131	9	B98-B107A
Boiler Fuel Conservation/ Oxygen Trim Control	Bldgs. 1776, 2278 & 3116	9,570	37,844	3.56	71.2	134,600	-	-	27	B60-B72
Automatic Chiller Condenser Tube Cleaning	Bldg. 1965	958	2,859	4.8	69.6	13,800	11,260	Pipefitter 125	9	B98-B107A
Chiller Modulation	Bldg. 2278	2,706	8,049	5.00	67.7	40,000			41	B16-B26

TABLE 8
SUMMARY OF PROJECT DATA
(Continued)

Project	Location(s)	Energy Savings/Year MMBtu	Dollar Savings/Year	Payback Years	E/C	Contract Cost	In-House Cost		Reference Pages Narr. Calcs.
							Material	Manhours	
Automatic Chiller Condenser Tube Cleaning	Bldg. 3176	1,508	4,486	5.55	60.6	24,900	20,400	Pipefitter 225	9 B98-B107A
Chiller Modulation	Bldg. 503	2,414	7,179	5.57	60.4	40,000	-	-	41 B16-B26
Ceiling Fans	Bldg. 229	171	480	5.92	60.1	2,800	900	Electrician 58 General 7	23 B44-B47
Chiller Modulation	Bldg. 1965	2,231	6,635	6.00	55.8	40,000	-	-	41 B16-B26
Chiller Modulation	Bldg. 292	2,194	6,526	6.10	54.8	40,000	-	-	41 B16-B26
Automatic Chiller Condenser Tube Cleaning	Bldg. 2281	550	1,635	6.3	53.3	10,300	8,450	Pipefitter 93	9 B98-B107A
Automatic Chiller Condenser Tube Cleaning	Bldg. 292	943	2,804	6.7	50.2	18,800	15,410	Pipefitter 169	9 B98-B107A
Chiller Modulation	Bldg. 3176	1,831	5,446	7.34	45.7	40,000	-	-	41 B16-B26
Boiler Feedwater Economizer	Bldg. 1776	1,665	9,957	3.90	42.8	38,900	21,400	Pipefitter 787	7 B1-B15
Boiler Feedwater Economizer	Bldg. 3176	3,471	10,135	9.13	37.5	92,500	50,900	Electrician 88	7 B1-B15
Infra-Red Heating	9 Bldgs.	1,386	4,048	9.70	35.2	39,400	30,100	Electrician 59 Pipefitter 330 General 75	14 B28-B32

TABLE 8
SUMMARY OF PROJECT DATA
(Continued)

<u>Project</u>	<u>Location(s)</u>	<u>Energy Savings/Year</u>	<u>Dollar Savings/Year</u>	<u>Payback Years</u>	<u>E/C</u>	<u>Contract Cost</u>	<u>Material</u>	<u>In-House Cost Manhours</u>	<u>Reference Narr.</u>	<u>Pages Calcs.</u>
Chiller Modulation	Bldg 2281	1,280	3,807	10.50	32.0	40,000	-	-	41	B16-B26
✓ Infra-Red Heating	Bldg. 236	93	271	10.70	31.9	2,900	1,950	Electrician 8 Pipefitter 30 General 10	14	B28-B32
✓ Infra-Red Heating	30 Bldgs.	5,584	16,323	11.40	30.0	185,600	121,300	Electrician 201 Pipefitter 2750 General 265	14	B28-B32
✓ Mess Hall Heat Recovery	Area 32	1,275	3,725	13.4	25.5	50,000	28,000	Sheet Metal Worker 1100	16	B33-B37
✓ Insulation	Bldg. 335	238	1,393	9.32	18.4	13,000	9,500	Insulator 176	39	B86-B88
✓ Insulation	Bldg. 339	350	2,046	9.62	17.8	19,700	13,900	Insulator 288	39	B95-B97
✓ Insulation	Bldg. 338	611	3,571	9.93	17.2	35,500	25,000	Insulator 523	39	B92-B94
✓ Insulation	Bldg. 337	92	541	13.50	12.7	7,300	5,100	Insulator 111	39	B89-B91
✓ Heat Recovery from Paint Spray Booths	Bldgs. 215, 236, 338, & 1800	499	1,456	55.0	0.26	80,000	-	-	22	B38